THE

YOUNG MECHANIC.

FEBRUARY, 1833.

For the Young Mechanic.

ON SPECIFIC GRAVITIES.

The question is often asked, What is the meaning of specific gravity? Men of scientific turn, but without much system in regard to any science, find it difficult to comprehend the difference between *common weight* and specific weight.

The subject is an important one, and ought to be well understood by every mechanic as well as professional man. It will be my aim, in this essay, to give a concise view of this important subject, in a manner, I hope, intelligible to all readers.

Specific gravity is a term continually made use of in physical science. It is used to express the weight of any particular kind of matter, compared with the weight of the same bulk of some other matter, which is supposed to be well known and easily accessible. This latter is considered as unity, or 1, 100, or 1000, as may be found necessary. This is called the standard, or that to which the weight of all substances must be referred. The substance generally used for this standard is pure water.

The weights of bodies, in a philosophical sense, are considered as measures of the number of material atoms, or the quantity of matter which they contain. This is, on the supposition that every *atom* of matter is of the same weight, whatever may be its variable form. Reference is had to specific gravity for ascertaining the weight of an atom in various ways, which I shall hereafter illustrate.

Notwithstanding the changes which heat and cold cause in the bulk of bodies, and the permanent varieties of the same kind of

matter, caused by a variety of circumstances, of growth, texture, &c. most kinds of matter have a certain constancy in the density of their particles, and therefore in the weight of their bulk. Thus the purity of gold, and its degree of adulteration, may be inferred from its weight, it being purer in proportion as it is more dense. The density of different kinds of tangible matter, becomes characteristic of the kind, and a test of its purity ; it denotes a particular appearance in which matter exists, hence termed *specific*.

But this density cannot be directly observed. It is not by comparing the distance between the atoms of matter in gold and in water, that we say the former is nineteen times denser than the latter, and an inch of gold contains nineteen times as many atoms as an inch of water ; we calculate on the equal gravitation of every particle of matter, whether of gold or water ; therefore the weight of any body becomes the indication of its material density, and the weight of a given bulk becomes *specific* of that kind of matter, ascertaining its kind and purity in their form.

In order to make this comparison of general use, it is evident that the standard must be familiarly known, must be uniform in its density, and the comparison of bulk and density must be easy and accurate. The most obvious method would be to form accurately a piece of the standard matter, of some convenient bulk, and to weigh it exactly, and rate its weight ; then to make the comparison of any other substance, it must be made into a mass of the same precise bulk, and weighed with equal care. The most convenient way of expressing the specific gravity, would be to consider the weight of the standard as unity, and then the number expressing the specific gravity is the number of times that the weight of the standard is contained in that of the other substances. This comparison is best made in fluids. We may make a vessel of known dimensions equal to that of the standard which we employ, weigh it when empty, and then when filled with the fluid. But a better way is, to use some fluid as a standard. Any vessel may then be substituted, and we may attain to very great accuracy, by using a viol with a slender neck, such as a small mattrass ; for when this is filled to a certain mark in the neck, any error in the estimation by the eye will bear a very small proportion to the whole. The weight of the standard fluid, which fills it to this mark, being carefully ascertained, is noted. The specific gravity of any other fluid is obtained by weighing the contents of this vessel when filled with it, and dividing the weight by the weight of the standard ; the quotient is the specific gravity of the fluid. But in all other cases, this is a very difficult problem. It requires very nice manipulations, and a very accurate eye, to make two bodies of the same bulk. It has been calculated that an error of 1-100 of an inch, in the linear dimensions of a solid body, makes an error of 1-30 in its bulk ; and bodies of irregular shapes, and friable texture, cannot be brought into suitable dimensions for measurement.

These inconveniences and difficulties were relieved by Archimedes, who, from the principles of hydrostatics, deduced the accurate method which is now universally practiced for discovering the specific gravity and density of bodies. Instead of measuring the bulk of the body by that of the displaced fluid, we have only to observe the loss of weight sustained by the solid. This can be done very accurately. Whatever may be the bulk of the body, this loss of weight is the weight of an equal bulk of the fluid, and we obtain the specific gravity of the body, by simply dividing its whole weight by the weight lost; the quotient is the specific gravity, when this fluid is taken for the standard, even though we should not know the absolute weight of any given bulk of this standard. We obtain, likewise, an easy and accurate method of ascertaining this fundamental point. We have only to form any solid body into an exact cube, sphere, or prism, of known dimensions, and observe what weight it loses when immersed in this standard fluid. This is the weight of the same bulk of the standard to be noted; and thus we obtain an accurate method for measuring the bulk or solid contents of any body, however irregular be its shape. We have only to determine how much weight it loses in the standard fluid; we can compute what quantity of the standard fluid will have this weight. Thus, if we should find that a quantity of sand loses two hundred and fifty ounces, when immersed in water, we learn from this that the solid measure of every grain of the sand, when added into one sum, is equal to the fourth part of a cubic foot, or to four hundred and thirty-two cubic inches.

The immediate standard, pure water, is, of all the substances with which we are acquainted, the best for an universal standard of reference. In its ordinary natural state, (viz. rain water,) it is sufficiently constant and uniform in its weight for every examination, where the utmost mathematical accuracy is not wanted. All its variations arise from impurities, from which it may be separated by distillation. When pure, its density is invariably at the same temperature.

Water is therefore universally adopted for the unit of that scale on which we measure the specific gravity of bodies, and its weight is termed 1. The specific gravity of any other body, is the real weight in pounds, or ounces, when of the bulk of one pound, or one ounce of water. It is, therefore, of the utmost importance, in all matters relating to the specific gravity of bodies, to have the precise weight of some known bulk of pure water.

In a future number, I shall make some further remarks on this important, but too much neglected subject.

J. R. C.

Quincy, Jan. 8.

GEOMETRY AND ARITHMETIC.

[Continued from page 15.]

PARALLELOGRAM.

A parallelogram is a four-sided figure, whose opposite sides are equal in length, and parallel or at equal distances from each other.

There are four kinds of parallelograms, viz. the square, rectangle or oblong, rhombus, and the rhomboid.

To find the area or quantity of surface in any variety of parallelogram. The length is to be multiplied by the perpendicular* breadth, and the product will be the area in square inches, feet, yards, &c. according as the dimensions are taken in inches, feet, yards, &c.

Fig. 1.

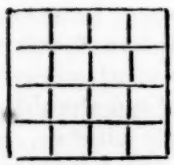
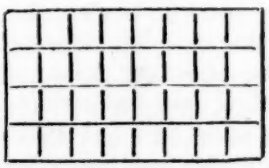


Fig. 2.



Example 1. If the side of a square be four inches, its area will be four times four, or sixteen square inches. This may be seen by inspecting figure 1, each side being divided into four parts, and lines drawn across the square from each division, divides it into sixteen small squares, which in this case are square inches.

Example 2. If the length of an oblong be eight feet, and the breadth four feet, its area will be thirty-two square feet. See figure 2.

It has been stated, (page 14) that if a circular vessel be put out of its regular shape, its area would be less. The same is true of the square. Mechanics know the difficulty of keeping their work square; hence it is a common practice for carpenters to brace their frames for doors and windows by a diagonal stay, which is

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*Perpendicular line. When a straight line meets another, so as to make the two adjacent angles equal, the lines are said to be perpendicular to each other.

The two parts of a correct carpenter's square are always perpendicular to each other, and it matters not how it is placed, whether on the bench or against the wall.

Suppose a straight stick to have a base, so that when placed on the floor of a room, it has no tendency to lean one way more than another—we say the stick is perpendicular to the floor; but if it is placed against a side wall, it will be perpendicular to that; and if placed on the slant roof of a house, it is then perpendicular to that part of the roof. The direction of a plumb line tends to the center of the earth, and is called a vertical line—it is also perpendicular to a level plane, such as that formed by still water.

not removed until the frame is secured in the wall of the building. Such a stay is represented by the line drawn across from opposite

Fig. 3.

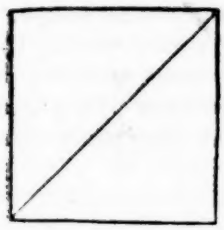


Fig. 4.

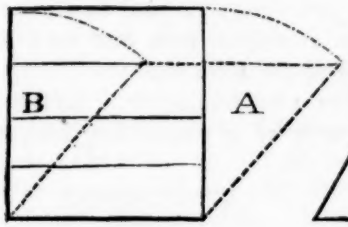
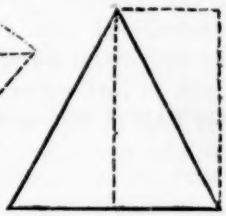


Fig. 5.



angles of figure 3. A good method of proving such work, is, to measure across from opposite angles both ways, and if they are of the same length, the work is square.

Figure 4 is a square. If we suppose it furnished with a joint or hinge at each angle, so as to be easily put out of the square form, it might be used to show the reason for taking the perpendicular breadth in measuring such figures. Let us suppose the lower side of the square to remain still, while the upper part is moved to the right, it will then assume the form of a *rhombus*, which is represented by the lower line of the square, and three dotted lines. The area of this figure is less than that of the square, for its perpendicular breadth is only equal to three-fourths of the breadth of the square. A part of the rhombus A, in a triangular form, projects beyond the square; if this was removed within the square, it would fill up the vacancy B. There would then be one-fourth of the square remaining at top, showing the difference between the areas of the two figures, that of the rhombus being only three fourths of the square, although its sides are of the same length.

If an oblong or rectangle, were put out of its regular shape, it would then form a *rhomboid*. It is evident that the only true way of finding the areas of these figures, is to multiply the length by the perpendicular breadth, for if we measured the slant breadth, the areas of the rhombus and rhomboid would appear to be the same as the square and oblong, which is evidently wrong.

The above examples, although simple, are very important, as the key to the measurement of all other figures. We can apply them to the triangle, and all the polygons, whether regular or irregular, they being made up of triangles; in fact, the circle is measured as a polygon of an infinite number of sides.

TRIANGLE.

The simplest geometrical figure, terminated by three straight lines, is called a triangle.

To find the area of a triangle. Take one side for the basis, and multiply it by half the perpendicular height; or half the basis multiplied by the whole height will give the area.

Example. Figure 5 is a triangle, with all its sides equal. A perpendicular, let fall from its upper angle, divides the base line into two equal parts. It is plain to the eye, that this triangle is equal in area to the oblong, whose breadth is equal to half the basis of the triangle, and length equal to the perpendicular height of the same. If this triangle was cut into two equal parts, they might be so placed as to form the oblong, in the same manner that figure 3 is formed by two triangles. In fact, the area of any triangle, is half of the area of a parallelogram, upon the same basis, and of the same height.

APPLICATIONS.

Any person who is well acquainted with the mensuration of a few simple figures, may with a little practice survey lumber, and the various kinds of artificers' work, such as painting, flooring, paving, &c. where the surface only is taken into consideration. Land surveying is conducted on the same principles. This subject is receiving much more attention in our schools than formerly, by the aid of books written in a more familiar style, and by the use of Mr. Holbrook's geometrical apparatus, children can learn in less time, and by seeing the real form of the object, the impression is more correct and also more lasting, than it would be from seeing a mere picture. PHILO.

CHEMISTRY.

[Continued from page 11.]

ATTRACTION.

Of the ultimate constitution of matter we know nothing. The hypothesis of Newton, that it is composed of hard indivisible particles, inconceivably minute, is well adapted to convey distinct notions of chemical phenomena ; and it is, moreover, though incapable of being proved, universally admitted. The particles of matter have been divided into two kinds, *Integrant* and *Elementary;* the former are those into which a compound body can be divided, without being decomposed ; the latter, those particles which are simple and incapable of division. For example—the atoms of marble are integrant, each consisting of carbonic acid and lime. If we decompose an atom of marble, we obtain carbon, oxygen, and calcium, all of which being incapable of further division, are called simple substances, and their ultimate particles elementary.

All matter is under the influence of a power, the tendency of which is to draw one portion to another. It acts both on the mass and on the minute parts of which bodies are composed. To this power the term ATTRACTION is applied. We shall first consider its action upon masses of matter, next upon integrant, and lastly upon elementary particles. It is a question among philosophers whether the operation upon these different states of bodies be referable

to one general cause, modified by circumstances, or whether there be an attraction, which acts only on masses of matter, and another on its particles. Modern philosophers are disposed to adopt the former opinion, and consider the attractions which exists between bodies as depending upon one and the same cause ; the different effects produced, however, have given rise to the divisions before mentioned, and, for the sake of perspicuity, they have been considered as different kinds of attraction.

The power by which bodies tend toward the earth, by which the bodies of the planetary system are regulated in their movements, and retained in their orbits, is called the attraction of gravitation, and extends to all matter at all distances. Were it not for this power, a stone thrown into the air would not fall to the earth, but continue its motion, in a straight line, unless stopped by the resistance of some body which it might encounter, or medium through which it passed. The force of the attraction of gravitation, is directly as the quantity of matter, and inversely as the square of the distance ; the quantity of matter being in different cases as 1, 2, 3, 4, the attracting force, at a given distance, will be as those numbers directly ; but if those numbers represent distances at which the body is successively placed, the attracting force will be 1-4th, or 1-9th, or 1-16th as great as it was at the distance 1.

Beside gravitation, there are other attractions which act upon the mass at sensible distances, viz. magnetic and electric attraction—the former illustrated by a loadstone drawing to it a piece of iron ; the latter by rubbing a stick of sealing-wax, or a glass rod, and holding it near small pieces of paper.

The attraction which acts between the particles of matter, at insensible distances, is termed *contiguous* attraction, in contradistinction to that before mentioned, which is termed *remote*. When simple or compound particles of the same kind are united, they are said to be held together by the attraction of *cohesion*, or aggregation. Thus the particles of *marble*, in a mass of marble, are united by cohesion, but the carbonic acid and lime of which the marble is composed, are united by chemical attraction. To show an example of the attraction of aggregation, place two globules of quicksilver on a smooth surface, and make them approach each other until they touch, when they will immediately unite and form one.

Cohesive attraction exerts different forces on different bodies, and on the same bodies under different circumstances. It is stronger in solids than in fluids. That it acts upon the latter is evident from the globular form which a drop of any liquid assumes ; but with aeriform fluids this power is entirely overcome ; their particles repel each other.

The form assumed by solids, as a result of cohesive attraction, depends upon the circumstances under which its influence takes place, sometimes an irregular mass being produced, at others regular figures called crystals.

Crystallization may be effected by dissolving the substance in a fluid, and separating a portion of the fluid by heat, or by melting the substance, and suffering it to cool slowly. The first method of producing crystals is by far the most common, and the fluid most used is water. Most substances, when separating from their solvent, carry with them a portion, and as the solvent most common is water, it is called *water of crystallization*, and upon this their hardness, transparency, and brilliancy often depends. The qnantity of water which crystals contain, differs with different substances. The crystals of carbonate of soda contain about two thirds their weight of water; the well known medicine Glauber's salt, contains about one half, and sulphate of lime about one-fifth its weight of the same liquid. Some crystals part with their water by exposure to the air; they are then said to *effloresce*. Others attract water from the atmosphere, and are said to *deliquesce*. Crystals which have but little water, when exposed to heat, (common salt, for example,) break with a crackling noise, undergoing what is termed *decrepitation;* those, on the other hand, which contain much water of crystallization, such as Glauber's salt, or nitrate of ammonia, when exposed to heat, liquify, by dissolving in their water, and are said to undergo *watery fusion.*

The forms which crystals assume are various, but each substance has a form peculiar to itself, and within a certain limit, this seldom varies; thus common salt crystallizes in cubes—Glauber's salt in oblique rhombic prisms—alum forms octahedral crystals. A considerable variety of forms occur in the same body, but in these cases, each contains one appropriate figure, from which all the diversities have sprung. Our limits will not permit us to enter further into this field of interesting enquiry. We must refer the reader, therefore, to the works on crystallography, and proceed to the investigation of CHEMICAL AFFINITY, a knowledge of which will be found of practical utility to every mechanic—to all of every profession.

Chemical attraction differs from all others in the results produced. Like cohesive attraction it acts only at insensible distances, but differs from this by uniting dissimilar substances, and producing a compound differing from either of its ingredients; thus, oil of vitriol and potash, either of which, if taken internally, would produce death, if mixed in certain proportions will unite and form a compound which may be taken into the stomach with safety, all its properties being entirely different from those of vitriol or potash.

If we mix together muriatic acid gas, and ammoniacal gas, chemical union will take place, and a solid salt will be the result.

Oil of vitriol, added to a saturated solution of muriate of lime, will also produce a solid, or nearly solid compound.

Crystallized nitrate of ammonia and Glauber's salts, rubbed together in a mortar, will form a liquid.

To a solution of copperas, add an infusion of galls. Both these liquids are nearly colorless, yet a deep black will be formed; add to this a little muriatic acid, and the black will disappear.

To a little blue vitriol, dissolved in water, add water of ammonia —a beautiful violet color will be produced.

To a solution of prussiate of potash, add a solution of copperas; a deep blue solid will form, which will fall to the bottom or *precipitate*.

To filings of copper add aquafortis; a rapid union will take place, and a blue liquid will be formed, which, on cooling, will form blue transparent crystals.

Produce a little nitrate of copper, moisten it with water, and wrap it up in a piece of tin foil tightly; the action will be so intense as to produce combustion.

Mix a little chlorate of potash with dry sugar, and touch the mixture with a drop of oil of vitriol; it will burst into flame with great brilliancy.

These are some of the experiments which serve to illustrate chemical affinity and chemical action. The former term, it should be kept in mind, is applied to the power which produces, and the latter to the change that takes place.

Some substances unite together in all proportions; such, for example, as acids and water, while others unite only in certain proportions; thus water will dissolve about one third of its weight of common salt, only; if more be added, it will remain solid. A fluid in this state is said to be *saturated*. But saturation with one substance, does not imply that the fluid is incapable of dissolving another substance. On the contrary, it is sometimes the case that a fluid, saturated by one substance, has its power of dissolving another substance much increased.*

Some substances combine together in only one proportion, while others combine in several definite proportions. When substances combine together in such manner as completely to disguise the properties of each other, the compound is called *neutral*. Common salt will serve as an example, it being composed of a powerful acid and caustic soda, yet possessing different properties from either.

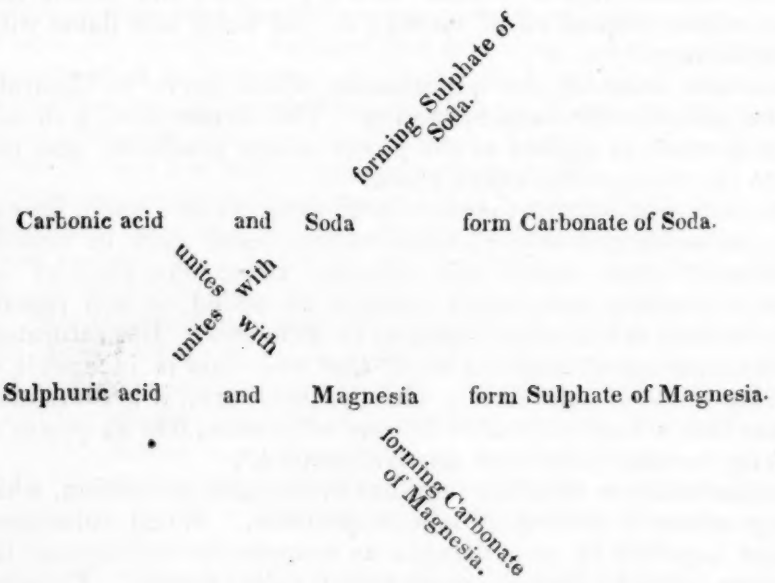
Some bodies, which have no affinity for each other, may be made to unite by the intervention of a third body having an affinity for both; thus oil and water may be agitated together for any length of time, without effecting a union, but if potash be added, the three substances will unite, and form the well known compound—soap. On the contrary, some bodies when united, may be separated by the addition of a third; thus, a solution of potash added to

* The combination here spoken of, and others similar, differ from chemical combinations, as the properties of the ingredient are not at all, or but little changed. They differ also from mere mixture, as separation cannot be effected by mechanical means.

Epsom salts, (a compound of oil of vitriol and magnesia,) will occasion a separation of the magnesia, by uniting with the oil of vitriol. We say the vitriol has a stronger affinity for potash than it has for magnesia.

If we add carbonate of soda to Epsom salts, instead of potash, two new compounds will be produced ; carbonate of soda being a compound of carbonic acid and soda, a double decomposition takes place, the carbonic acid of the carbonate of soda uniting with the magnesia of the Epsom salts, and the acid of the Epsom salts uniting with the soda of the carbonate. To this affinity the terms *double elective* are prefixed, and to the former those of *single elective.*

These cases of double decomposition are best illustrated by a diagram.


forming Sulphate of Soda.
Carbonic acid and Soda form Carbonate of Soda.
unites with
unites with
Sulphuric acid and Magnesia form Sulphate of Magnesia.
forming Carbonate of Magnesia.

For the Young Mechanic.

LAWS OF MOTION.

REPLY TO J. M. W.

MESSRS. EDITORS,—When perusing the last number of the Young Mechanic, I observed an article entitled 'the evidences of the rotary motion of the earth ;' the object of which was, to obtain an explanation of the assertion made by Professor Farrar, 'that a body let fall from some distance above the earth's surface, as from the top of Park-street steeple, would not strike a point directly under it, but would strike the earth west of that point.' This assertion, I think, is perfectly correct. The body, while falling, is act-

ed upon by two forces ; one is the force of gravity, and the other the projectile force given it by the steeple. The last force is constantly diminishing, because the moment that it is set at liberty, the original projectile force is stopped—consequently it moves forward only by its own momentum, which is constantly decreasing, and will finally be overcome by gravity, and strike the earth west of the point directly under that from whence it started.

G. W. M.

ESSAYS ON KNOWLEDGE.—No. II.

DEFINITION, &c.

In my first essay, I recognized the doctrine of the existence of a Creator and Governor of the Universe, which I consider established. But this, together with many other propositions which I may assume as correct, without entering into a discussion of them, may be illustrated in the course of the series. I shall bear in mind the department in which I am writing, and endeavor, in all cases, to keep within the sphere of simple philosophical reasoning.

There are two kinds of knowledge; *intuitive* and *discursive*. Intuitive knowledge is immediate perception of truth ; discursive, that which is obtained by deduction of reason. For example—the knowledge that a whole is greater than a part, is obtained by immediate perception ; while the knowledge that three angles of a triangle are equal to two right angles, is obtained by deduction of reason.

All the knowledge possessed by the Author of the universe is probably intuitive ; all the knowledge man obtains, is acquired by intuition and deduction of reason.

The doctrine of *innate ideas* may be considered as exploded ; though there is not so great a difference in the opinions of the different schools of philosophers on this subject, as some suppose. That sensation and reflection furnish mankind with the first materials of all their knowledge, is not now disputed.

It is said that the mind is the eye of the soul. This is undoubtedly true in some sense ; but I think it will lead to less confusion, as to terms, to assume that both the mind and the soul are comprehended in the term *mind*. I consider the mind as including all of what is called the spiritual part of man. It may therefore be more proper to say, that the faculty of understanding is the eye of the mind. It is also said, that by knowledge the mind perceives truth, as by vision the eye sees light. This is very well, except that, strictly speaking, *understanding* should be substituted for *mind*, in this case.

Some have been led to the conclusion, that a knowledge of everything is necessary, in order to understand any one thing fully.

This is unsound. If the mind could know all truth, it would be as comprehensive as the mind of God. 'As the eye may see corporeal objects, without seeing the nature, the number, the form, or positions of their interior elements, so the mind of man may know things and truths, without knowing all their causes, relations, properties, and effects. The eye may see the ocean, without being able to see its depth or extent; and the mind of man may see God, without being able to know all the perfections of his infinite nature.' One truth after another may be communicated to the mind, in its present state, by intuition and deduction of reason, as perfectly as if it were in possession of all other truths. Every thing above human comprehension, may properly be termed *mystery*.

L.

PATENTS FOR MASSACHUSETTS,

GRANTED IN MAY, 1832.

From the Journal of the Franklin Institute.

For *Fastenings for Bedsteads, Sofas, &c.* John P. Allen, Manchester, Essex county, Massachusetts.

The nature and antiquity of this invention, will be rendered apparent by the claim, which is to 'the application of the right and left hand iron screw to bedsteads, sofas, and couches, for the purpose of fastening together into solid frame work.' We have neither time nor inclination to ascertain how many patents have been issued for putting beadsteads together by right and left handed screws, but recollect several; in some of them it is proposed to make the screws of wood, and in others of brass. Whether or not *iron* has been mentioned, we cannot say; and, if not, the present patentee has the 'forlorn hope' of sustaining his claim, by a strong material, it is true, though not by any thing which he has *invented* or *discovered;* he having merely substituted one well known material for another, which attains the same end, and by the same means.

For a *Washing Machine*, called the double cylinder washing machine; John S. Pulsifer and Ebenezer Pulsifer, Ipswich, Essex county, Massachusetts, May 21.

This machine is so truly a counterpart of that patented by Mr. Simon Savage, on the 11th of April last, and described p. 236, that we shall merely refer the reader to the account there given, for a full display of the present invention.

For a *Stereotype Block;* Bradbury Hackett, Boston, Massachusetts, May 21.

For an improved *Printing Press*, denominated the 'Faustus Printing Press;' Seth Adams, Boston, Massachusetts, May 23.

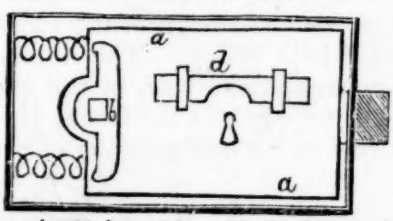
We shall not attempt to describe the manner of arranging the various parts of this press. The patentee claims 'the combination of the crank, the cam, and other parts together, so as to move the platen, or frisket, and produce the effects described. The press is to be operated upon by hand, a handle being attached to a fly-wheel for that purpose, as in several other presses.

For an improvement in the *Apparatus for Baking or Roasting*, usually called the reflecting tin baker ; William Prescott, Boston, Massachusetts, May 24.

This is confessedly the common tin kitchen, but an improvement in it is claimed, which consists in placing the pan or trough, which collects the gravy, close to the front, and allowing the lower part of the kitchen to slope forward, so as to carry all which falls upon it into the trough. This constitutes the invention, and forms the subject of the claim.

For a *Metallic Stereotype Block;* Samuel Sawyer, Boston, Massachusetts, May 29.

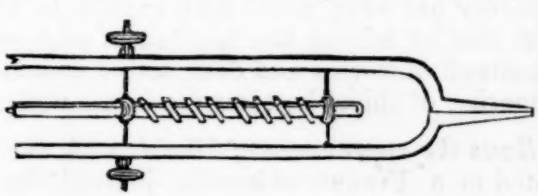
For *Spring Catches or Locks for Doors;* Robert J. Byram, Boston, Massachusetts, May 31.



We cannot give the precise structure of this lock, without a more lengthened description than we can allot to it. One of its principal features, however, is the making the bolt in such a way that it forms a frame, the rim of which slides against the sides of the box of the lock, as seen at *a a*. The tumbler *b*, standing in the center of this, draws the bolt back, which is forced forward by the spiral springs. A small bolt, *d*, shooting against the frame, may serve to lock the door. The patent is taken for these and certain other particular arrangements.

CENTRE POINT SPRING BIT.

Patented by Daniel Flint, Nobleborough, Maine, April 19, 1832.



This bit may be likened, in form, to a tuning fork, the handle of which would represent the shank, and the forked ends the cutting points. One of these points is notched, so as to cut a double groove, and the opposite point is chisel shaped, to cut out the stuff between the two grooves. The bit may be fixed in a lathe, or stock. To guage it to the exact size required, a thumb screw

passes through the two forks, and by means of this the points may be drawn together. The inside edges of the cutting ends may be so formed as to give a taper or beviled entering to the plug which is to be cut out by it. There is also a centre piece, which, being borne up by a spiral spring, recedes as the points advance.

The principal intention of the bit is to manufacture plugs for ships, although it is applicable to other purposes, such as making bungs for barrels, &c.

Miscellany.

Durability of Watches.—The durability of common watches, when well made, is very considerable. One was produced, in '*going order*,' before a committee of the House of Commons, to inquire into the watch trade, which was made in the year 1660; and there are many of ancient date in the possession of the clock-makers' Company, which are actually kept going. The number of watches manufactured for home consumption, was, in the year 1798, about 50,000 annually. If this supply was for Great Britain only, it was consumed by about ten and a half millions of persons.

Improvement.—Mr. E. Palmer, of Buffalo, N. Y. has invented a new method of making nails for shoeing horses and oxen, for which he has obtained a patent. It is an invention which promises to be of great value to the community and to the inventor, who is at present the principal proprietor. Some idea may be formed of its importance, from the fact that one man can manufacture nails in this way, at least as fast as fifty men can in the usual way.

Ship Caulking.—It is stated in the French Journals, that an important discovery has been made with regard to the caulking of vessels; viz. that by mixing the essence of tobacco with the pitch and tar, the attack of worms and destructive insects is prevented, and the coppering of ships' bottoms rendered unnecessary.

To give Busts the appearance of Marble.—A curious process is communicated in a French scientific journal for giving to busts and statues in plaster the appearance of marble. Dissolve alum in water to a strong solution by means of heat. The bust is then thoroughly dried, and in that state plunged into the liquid solution, where it is left from fifteen to thirty minutes; then it is suspended over the liquid till it ceases to drop. When it is cool, apply more of the solution to it by means of a sponge, and continue the opera-

tion until the alum forms a chrystalline coat on the surface. When it is perfectly dry, polish it with sand paper, and finish by polishing it with linen, slightly moistened in pure water. Use a tub of wood heated by means of a boiler of water for the solution in preference to metallic substances, which will discolor it more or less.'

Gas Lights.—A committee of the Philadelphia City Council has reported in favor of lighting the city with gas, and that the City Solicitor concurs with them in opinion that they 'may draw upon the Gerard estate for the amount required, of course regarding the will of the testator with regard to primary objects, viz. the College and the City police. They calculate that the saving will be 33 1-3 per cent. over the use of oil. The whole expense is estimated at $687,064. The cost of the works will be $200,000—of 552,873 feet of pipe and laying, 424,564,71. In Baltimore, the gas company furnish 3000 private and 100 public lamps. They have incurred great expense in the erection of two setts of works, the first being a failure. They do not limit the quantity of gas to time, yet their stock is 35 per cent. above par, and pays 8 per cent. dividend. In New-York, the gas company lights 10,000 private and 376 public lamps, and though they lose annually as a bonus to the city, 4 or $5000, in furnishing the city lamps, their stock is 40 per cent. above par, pays 10 per cent. premium, and a surplus is annually kept in reserve.

In Boston the works are private property.

The committee believe that, at the rates above given, the use of gas will save 33 1-3 per cent. upon the present expenditure, and as the profit of manufacturing is considerable, they believe that nearly the whole tax for lights will be saved, by the amount of private burners supplied.

Law Suit.—A suit, by Dr. Nott against a person for infringing his patents for coal stoves, was lately tried in the U. S. Court for the Northern District of New-York. An effort was made on the part of the defendant to show that the principles of the improvement were not new, and the patents consequently void. The case was summed up to the Judiciary by the Doctor himself, and the Jury rendered a verdict of $850 damages, which, according to the statute, are to be trebled. From the testimony adduced on the trial, it appears that the Doctor has not 'rested from his labors,' but is still proceeding with his experiments on this subject. From the success which has attended him thus far, we have reason to hope for still further improvements from his researches.

ANSWER.

MESSRS. EDITORS—In answer to the question in your last respecting the wheels of the carriage, I would say, the circumference of the greater is five yards, and the less four yards.

My solution is as follows:

Let x=circumference of fore wheel,

" y= do. " hind "

Then by the question, 1 $\frac{120}{x}=\frac{120}{y}+6$

2 $\frac{120}{x+1}=\frac{120}{y+1}+4$

Clearing of fractions, 3 $120y=120x+6xy$

And uniting terms, 4 $116y=124x+4xy+4$

By transposition and 5 $x(120+6y)=120y$

Separating factors, 6 $x(124+4y)=116y-4$

And

7 $x=\frac{120y}{120+6y}$

8 $x=\frac{116y-4}{124+4y}$

Then by proportion, $116y-4 : 124+4y :: 120y : 120+6y$

By multiplication of extremes and means, $696y^2-480-24y+13920y=14880y+480y^2$

By uniting terms, $216y^2-984y=480$

Dividing by 216, we have, $y^2-\frac{984y}{216}=\frac{480}{216}$

By completing the square, $y^2-\frac{984y}{216}+\frac{242064}{46656}=\frac{480}{216}+\frac{242064}{46656}$

By extracting the root of both sides And transposition, we have, $y=\frac{492+588}{216}$

Consequently, $y=5$

By putting the value of y in 3d equation, we have $600=120x+30x$

And $x=4$

E. G.

QUESTION.

There are two cubical pieces of composition, valued at $136 2-3, each of which cost as many (1-6 dollars) per solid inch, as there are inches in a side of the other, and the greater stands on a larger base than the less by nine square inches. Required the side and price of each?